TRK-10-005 Status Update

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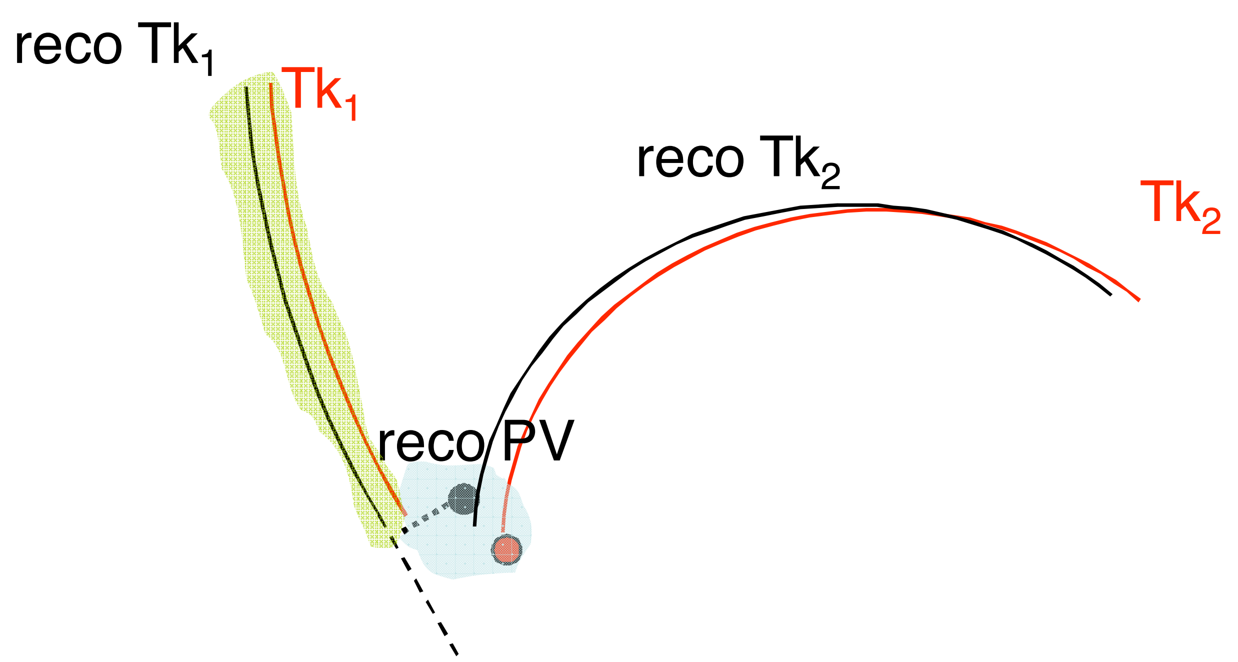
for TRK-10-005 Analysts

Track IP Resolutions

Track Impact Parameter Resolutions

- Track IP resolutions can be extracted from IP(pvtx position) by unfolding the vertex resolution in a data-driven way

$$d0_{meas} = d0_{true} \oplus \text{"vertex smearing"} \oplus \text{"track impact parameter resolution"}$$



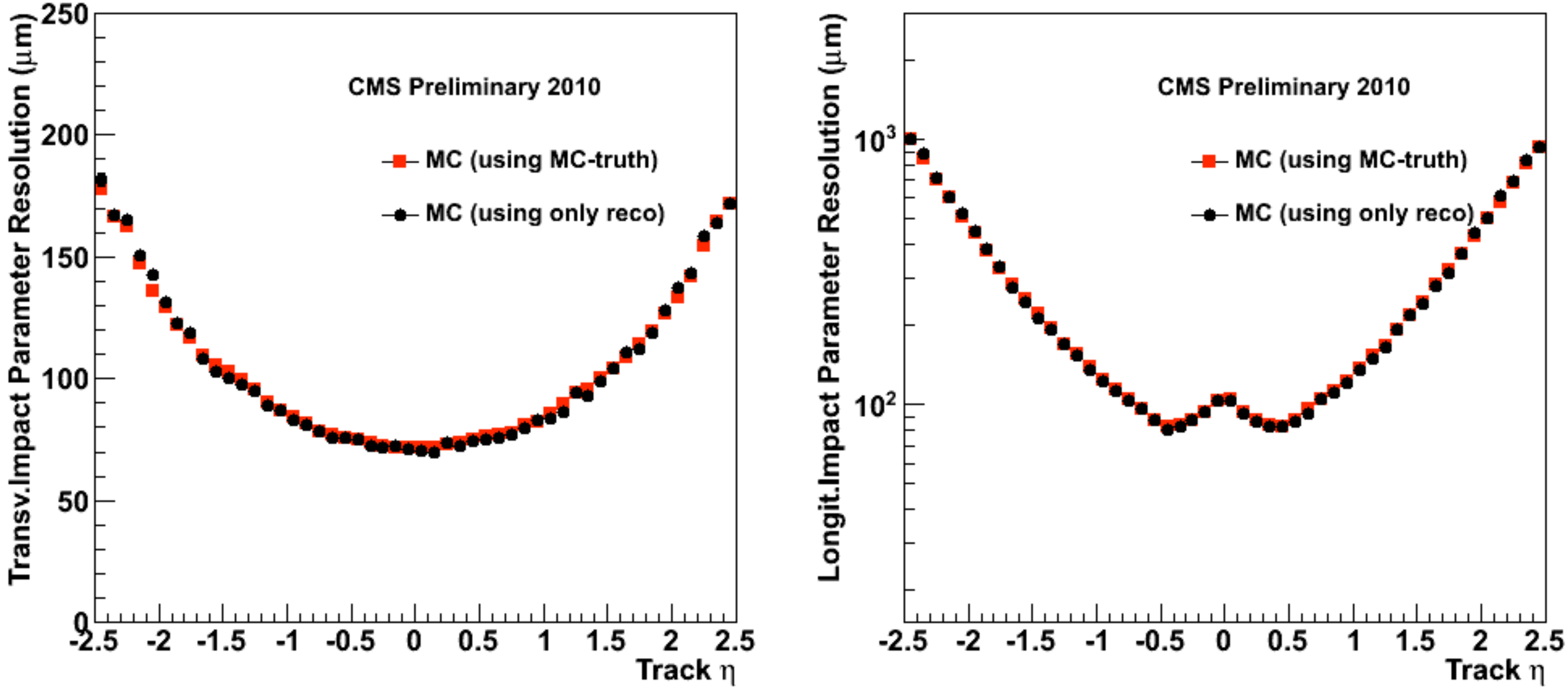
- This method can be validated in MC by comparing the results to the results obtained via MC-truth method (reco-sim)

- Details given at this talk by Boris Mangano

http://indico.cern.ch/getFile.py/access?contribId=3&resId=1&materialId=slides&confId=84502

Method Validation on MC (1/2)

- IP resolutions vs eta, with pT>0.8 GeV



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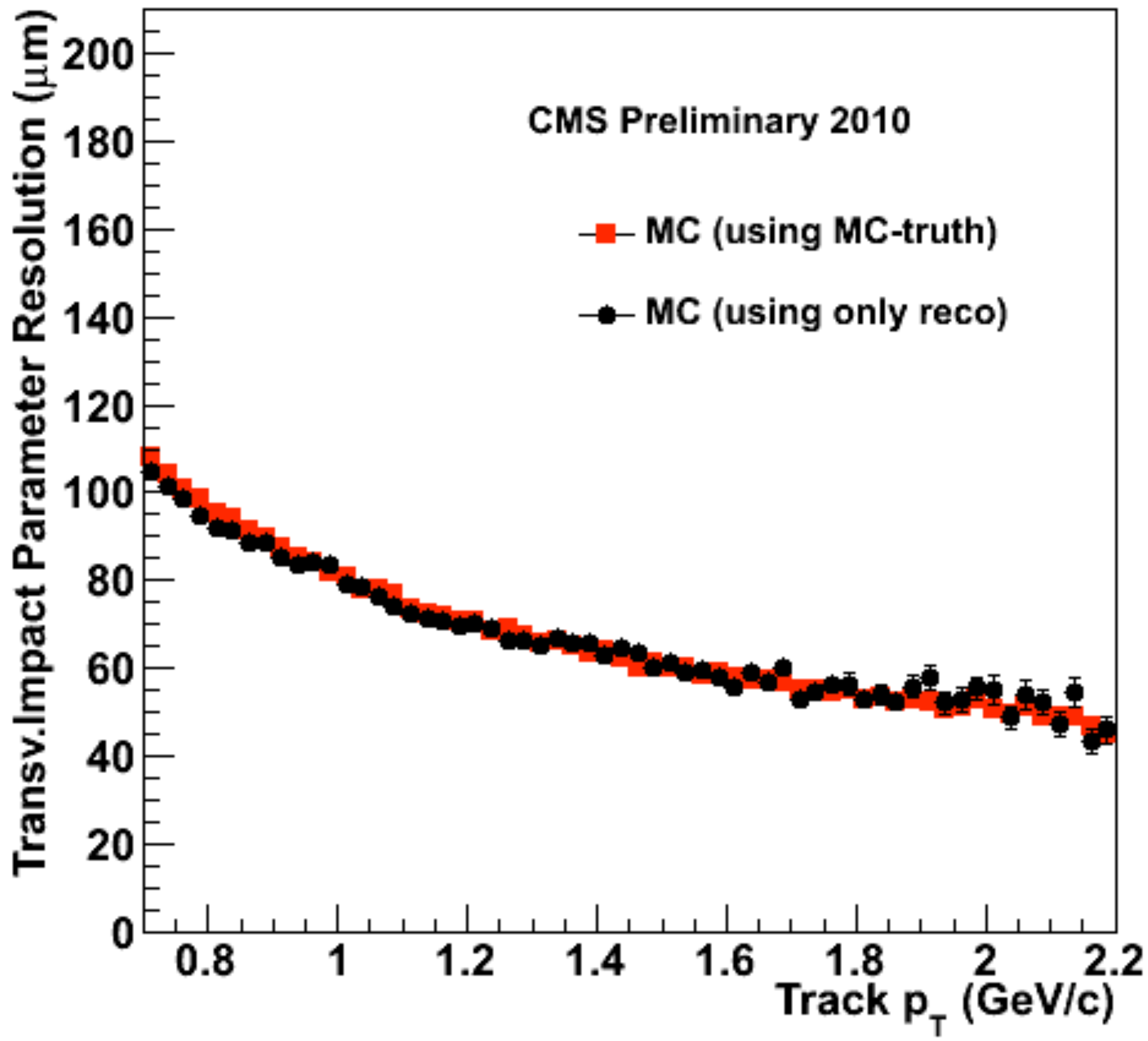
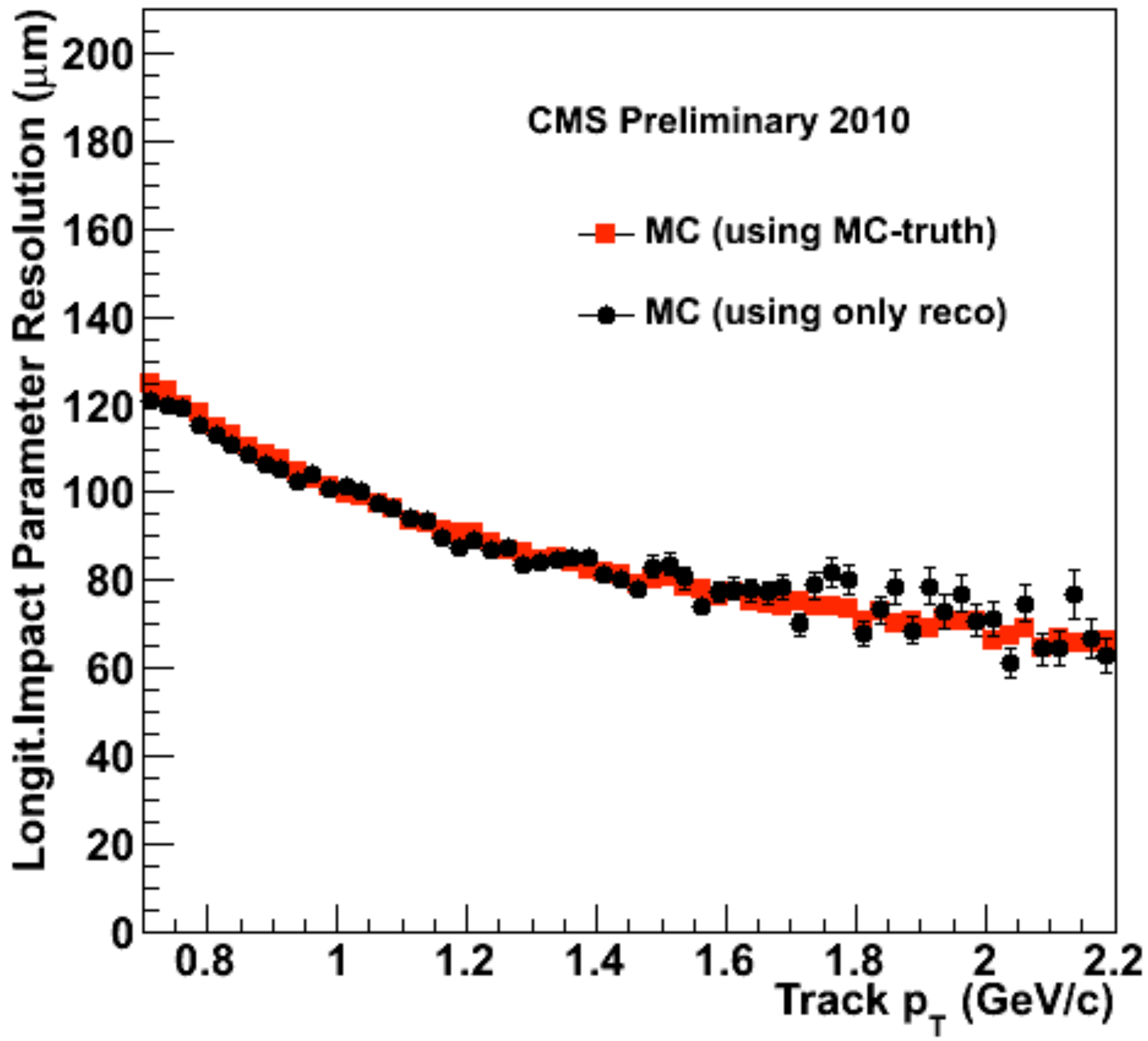
Method Validation on MC (2/2)

- IP resolutions vs pT

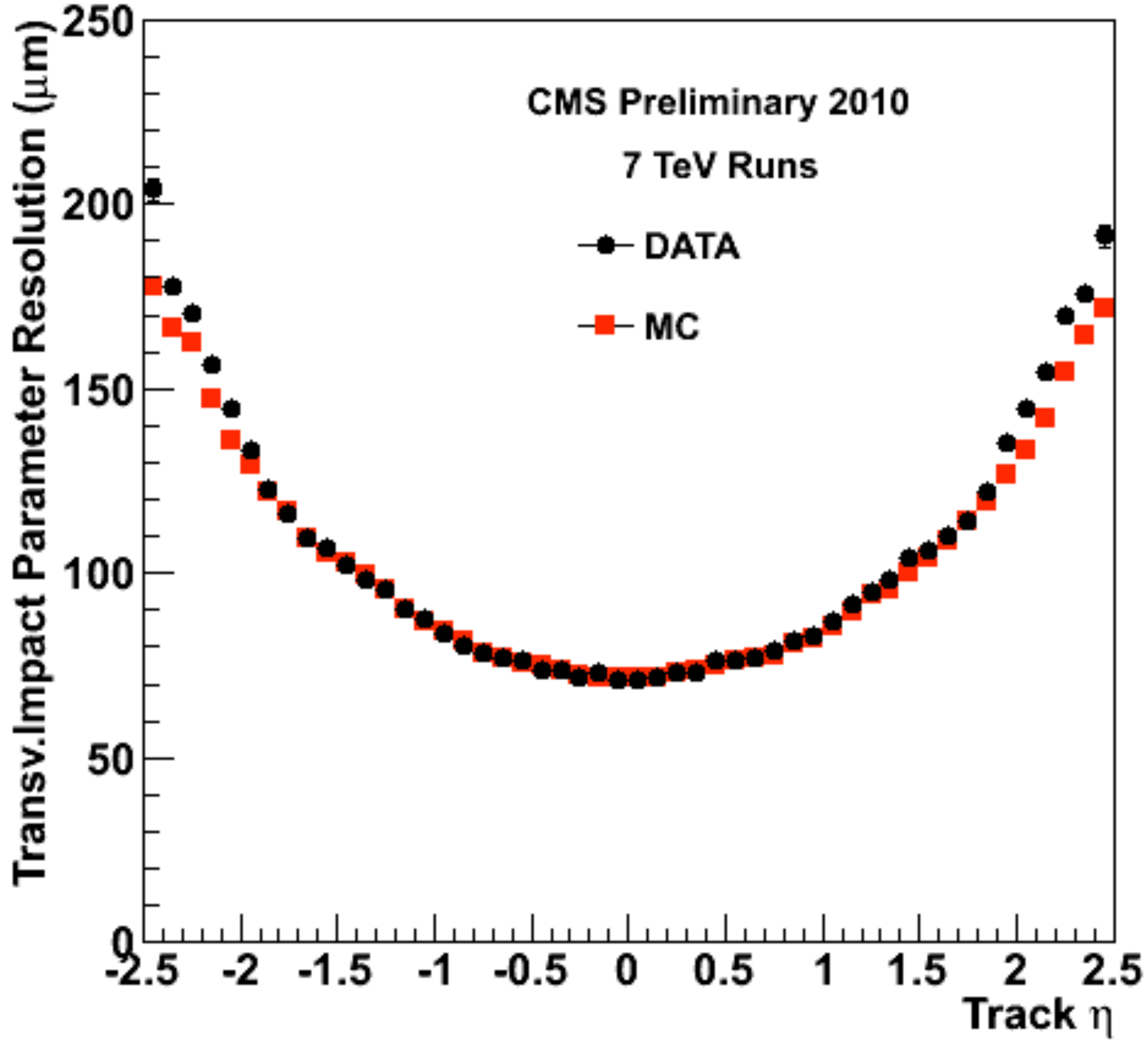


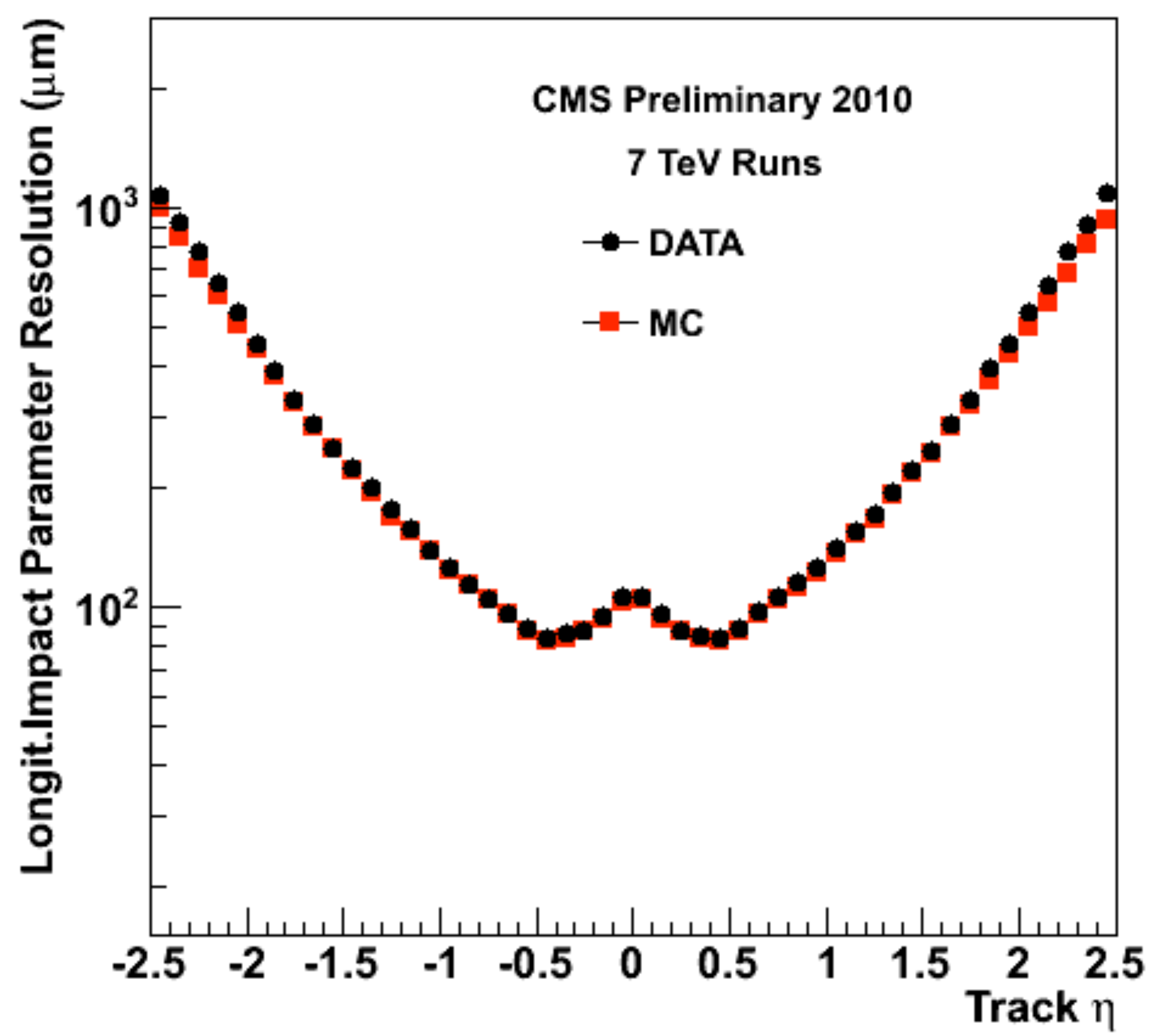


- The pT range can be extended by running on the un-prescaled data skim

Data-Driven Results on Data/MC (1/2)

- IP resolutions vs eta with pT>0.8 GeV (to be included in PAS)

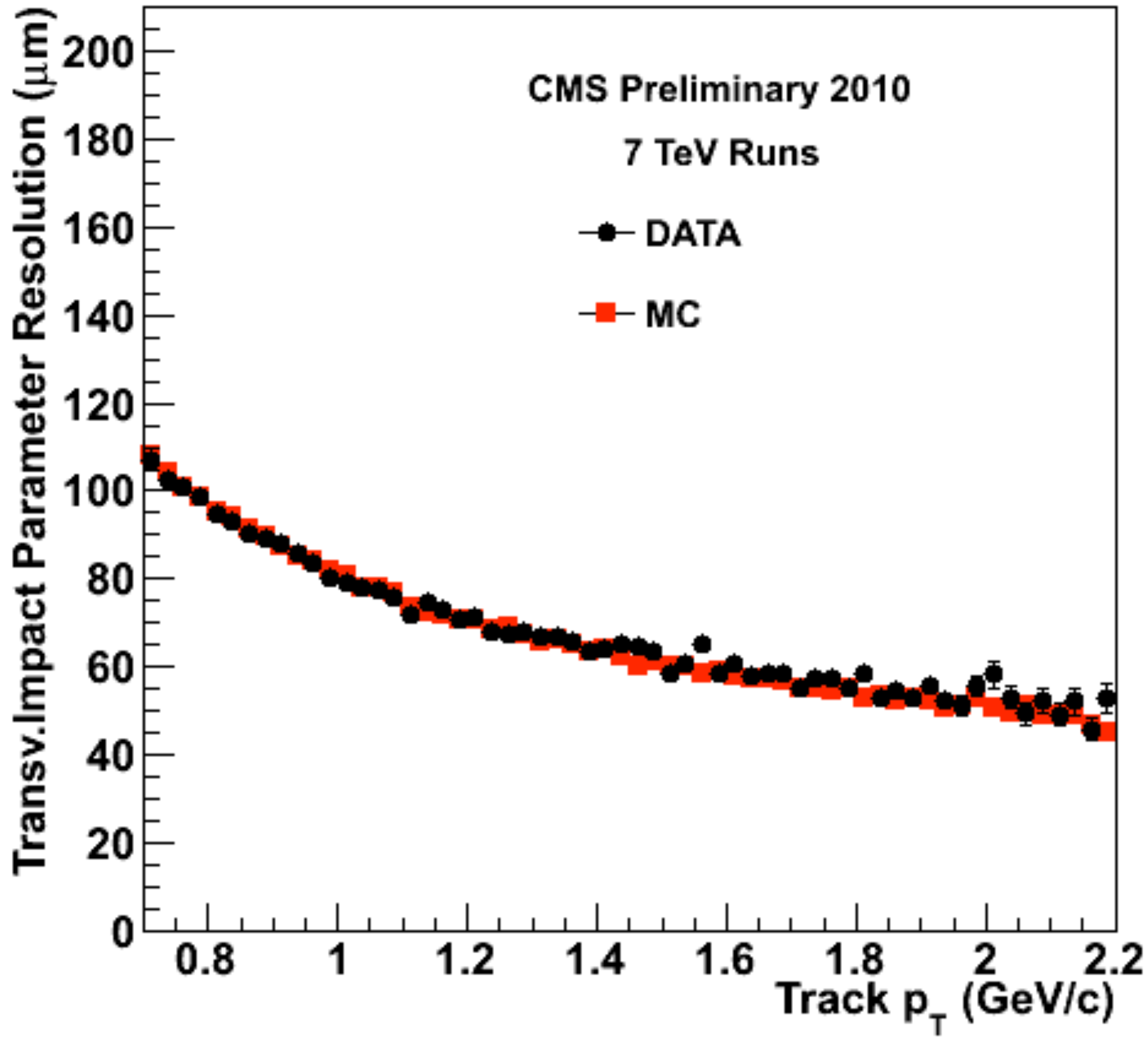


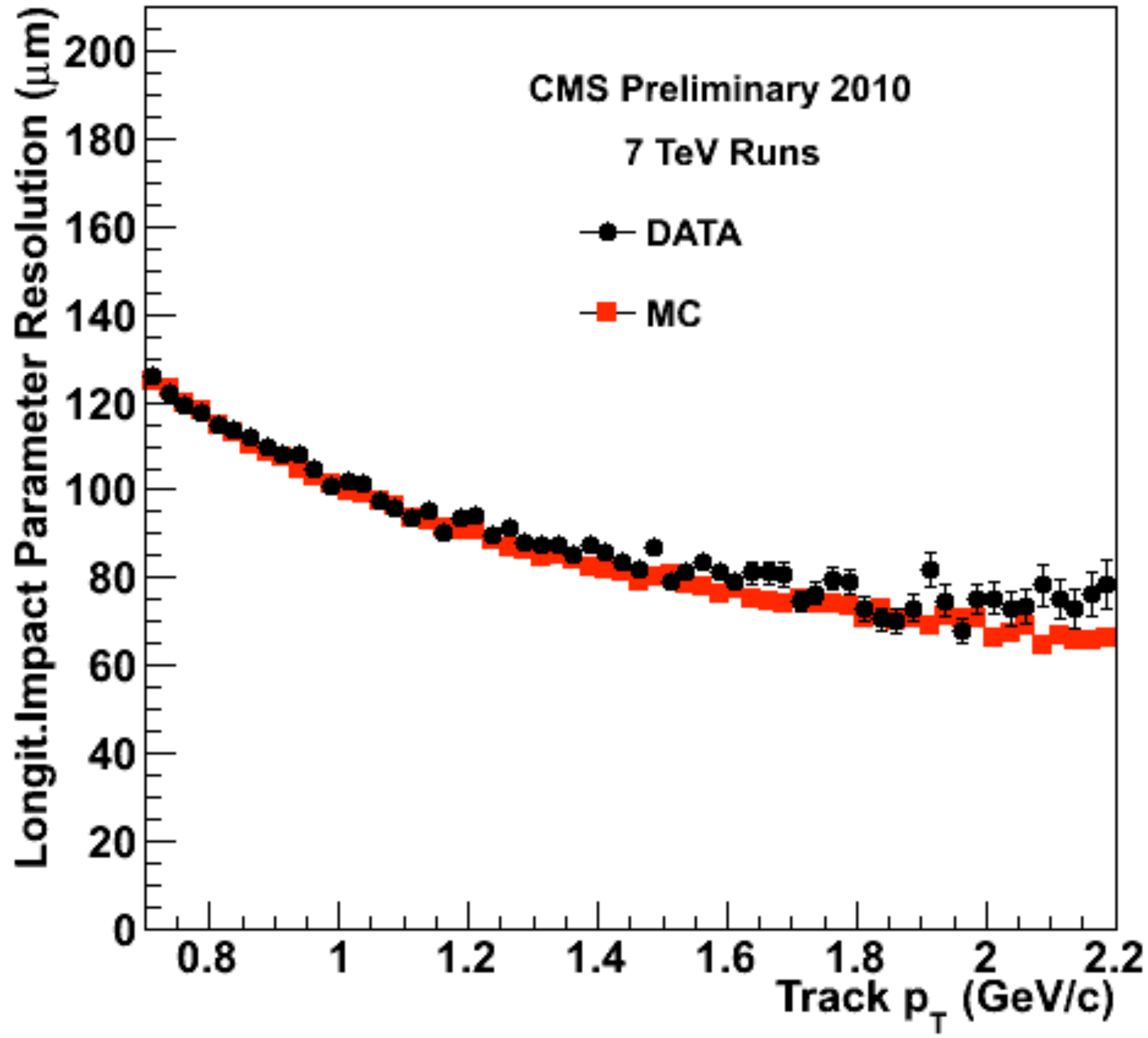


- The discrepancies at high |eta| region could be due to the data/MC difference in material or mis-alignment

Data-Driven Results on Data/MC (2/2)

- IP resolutions vs pT (to be included in PAS)



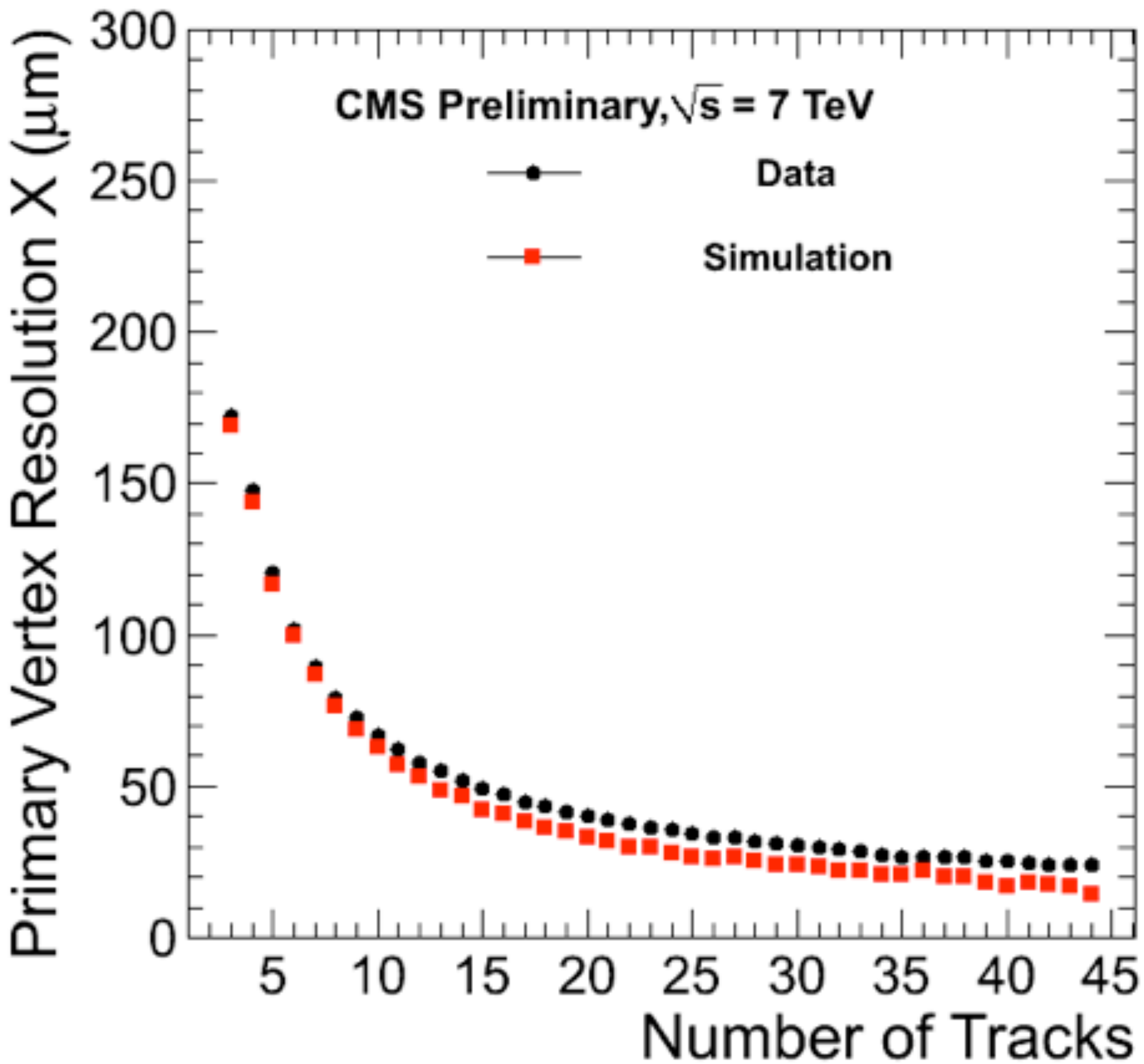


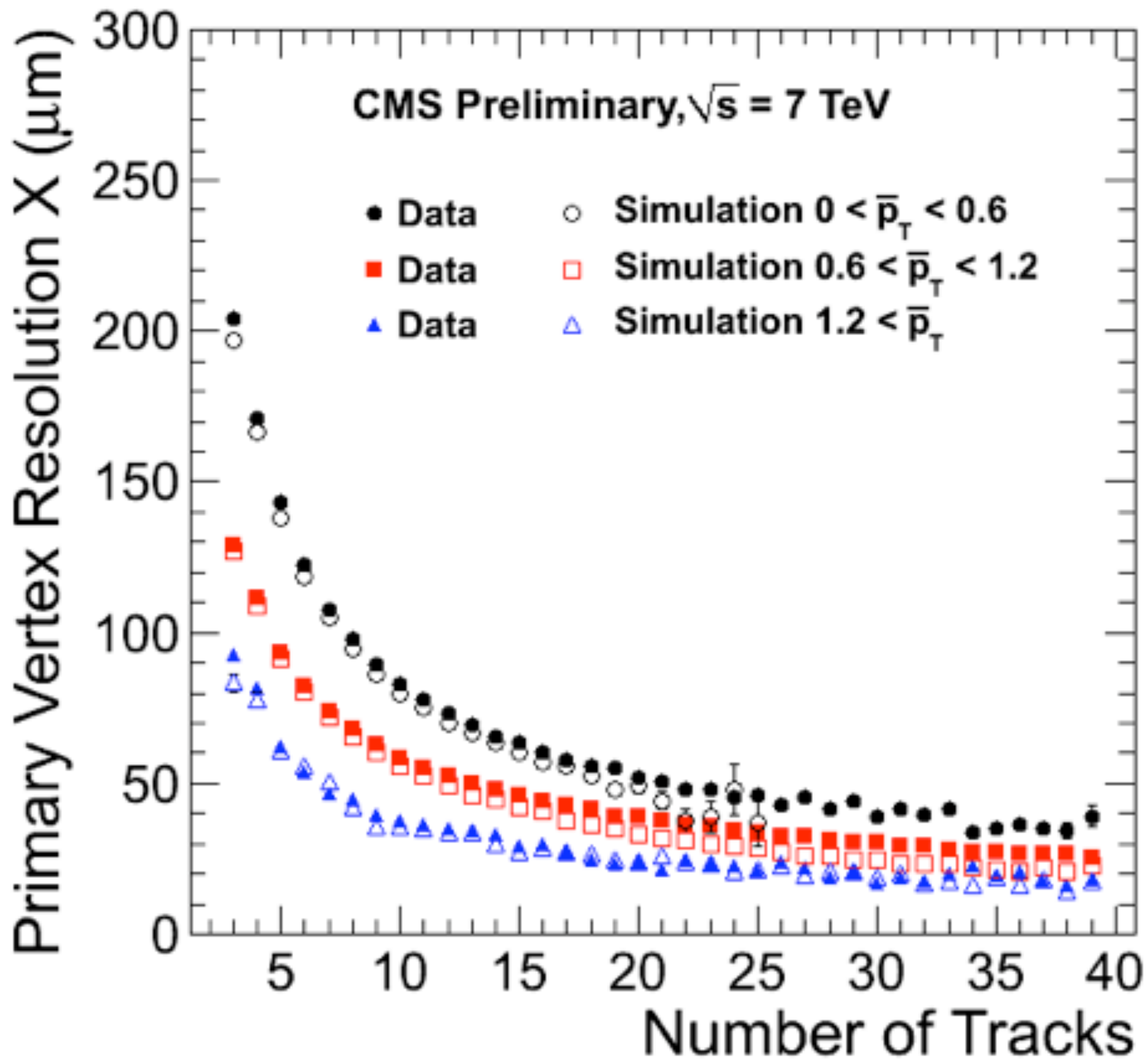
- The last a few bins will be improved with more statistics and selecting hard interaction trigger bits (JET6?)

Primary Vertex Resonstruction: Resolution and PileUp

Primary Vertex Resolution X vs nTrack

- Strong dependence on the pT of the vertex in the low end

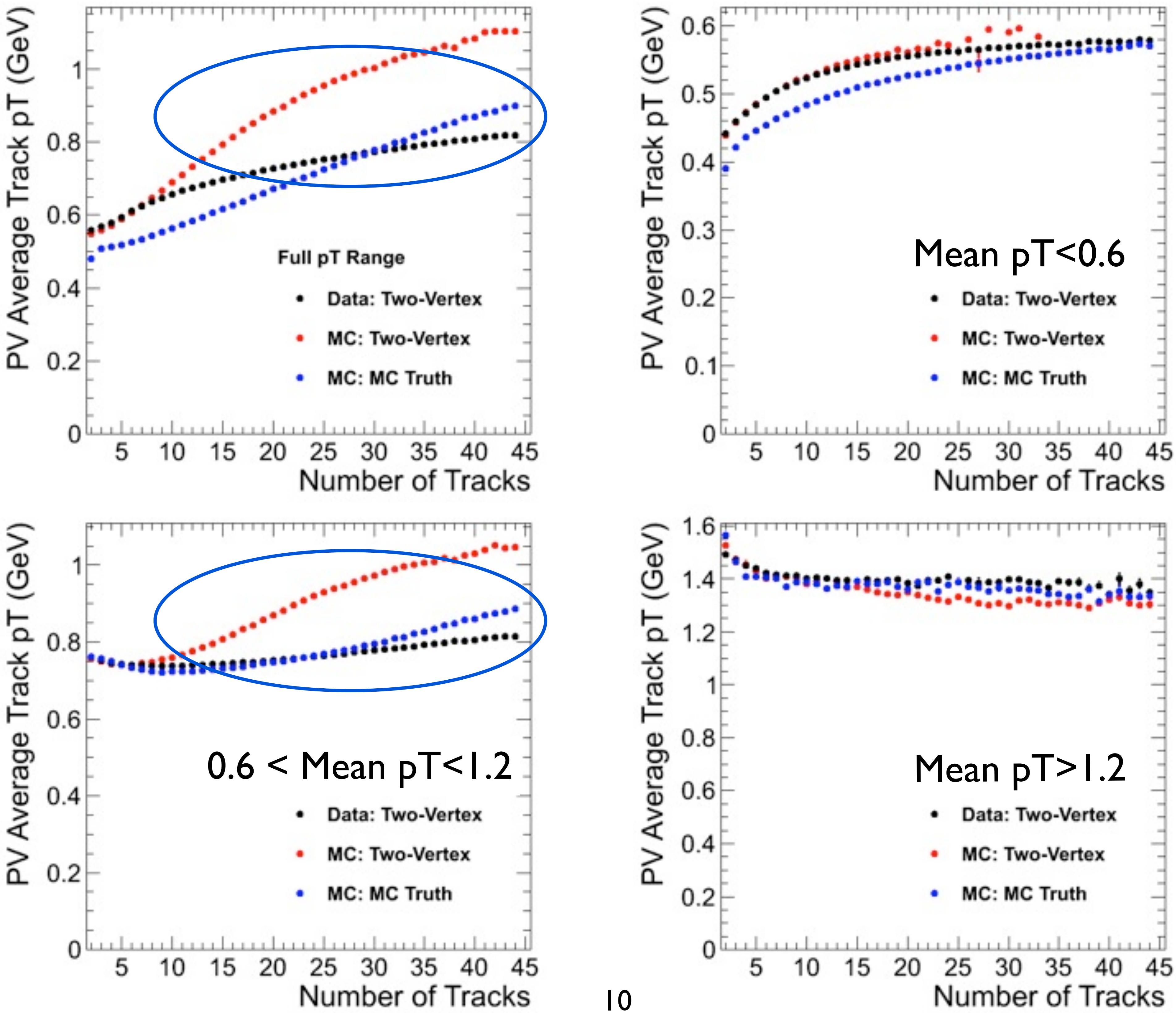




- In the high nTrack region, the data resolution is slighter larger than MC
- This difference is due to the data/MC difference in the track pT (slide X)
- Plots to be included in PAS

Average Track pT in Vertex

- pT difference drives the data/MC discrepancy in the tail in Res



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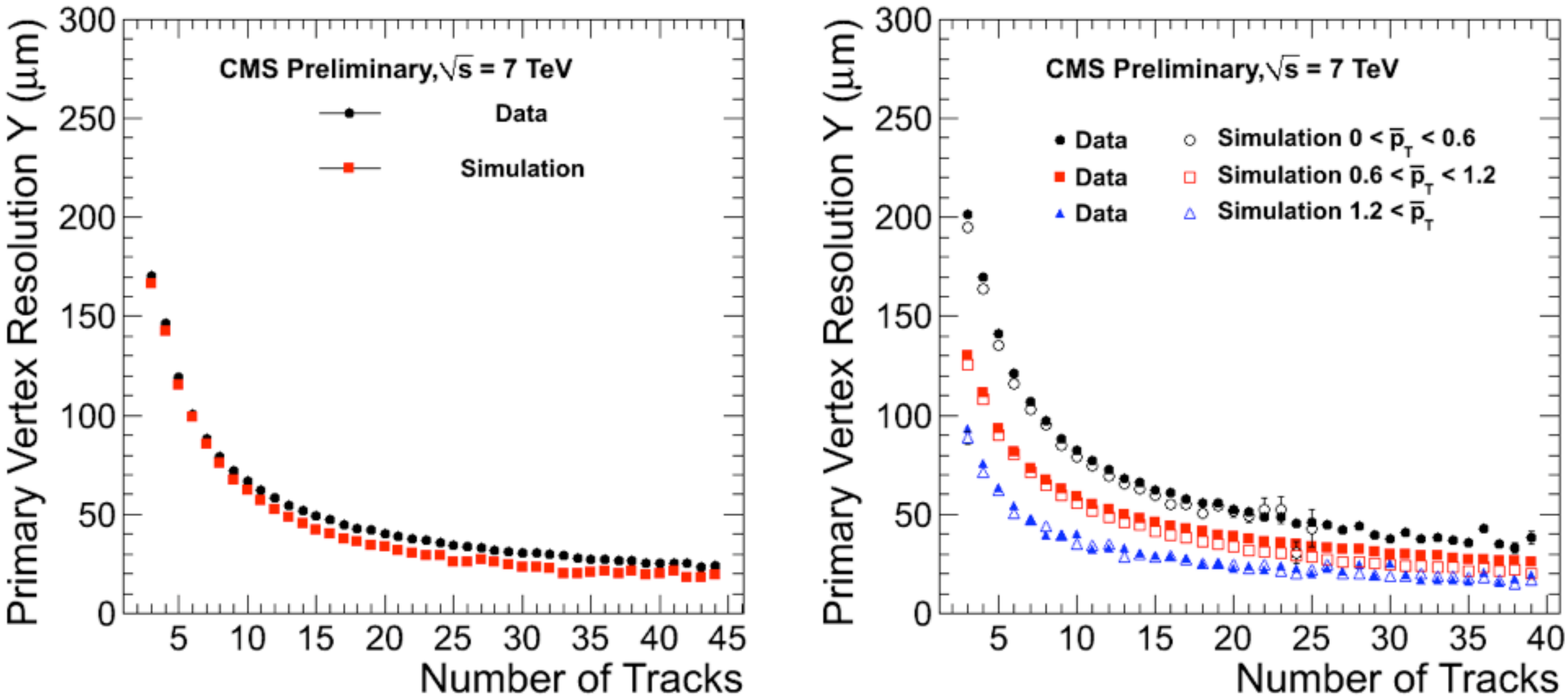

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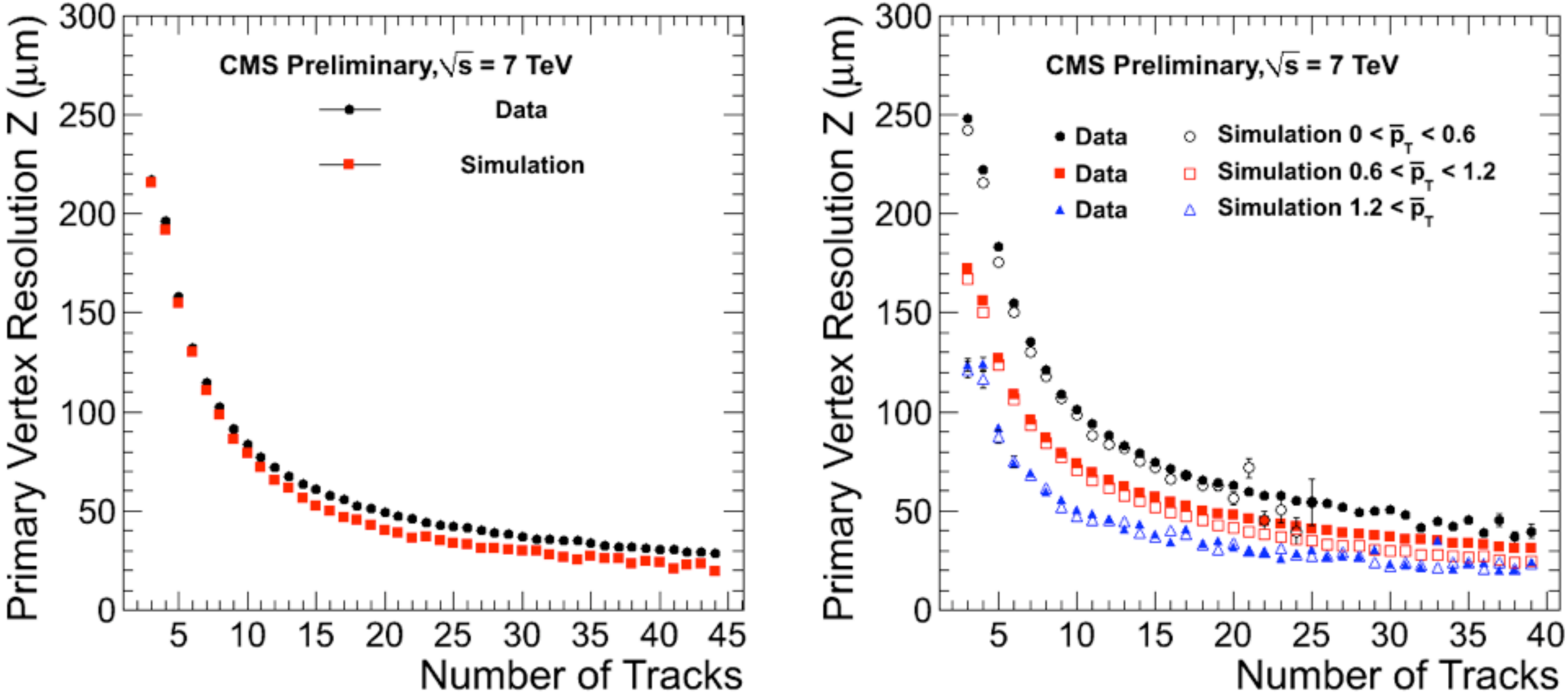

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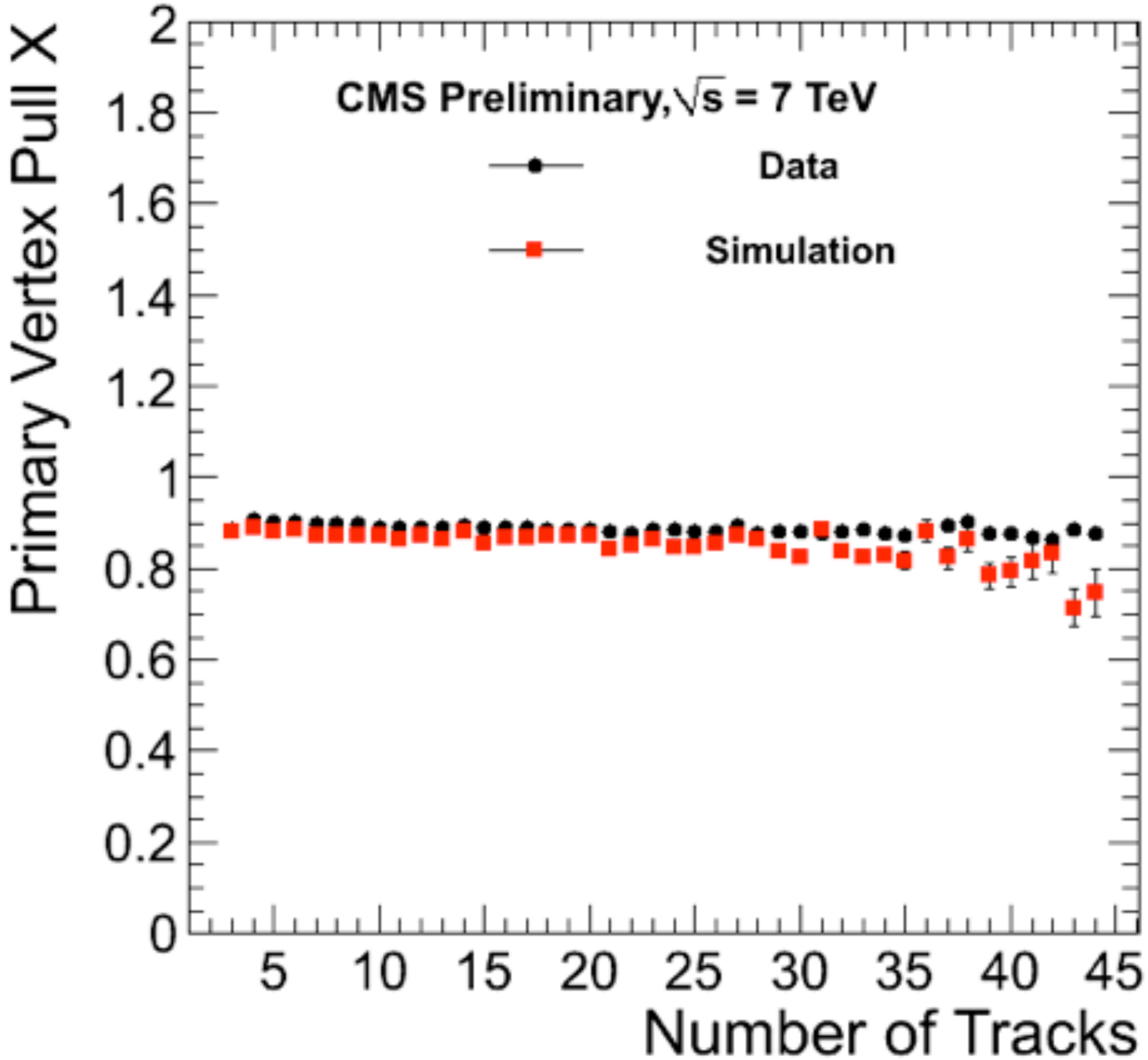
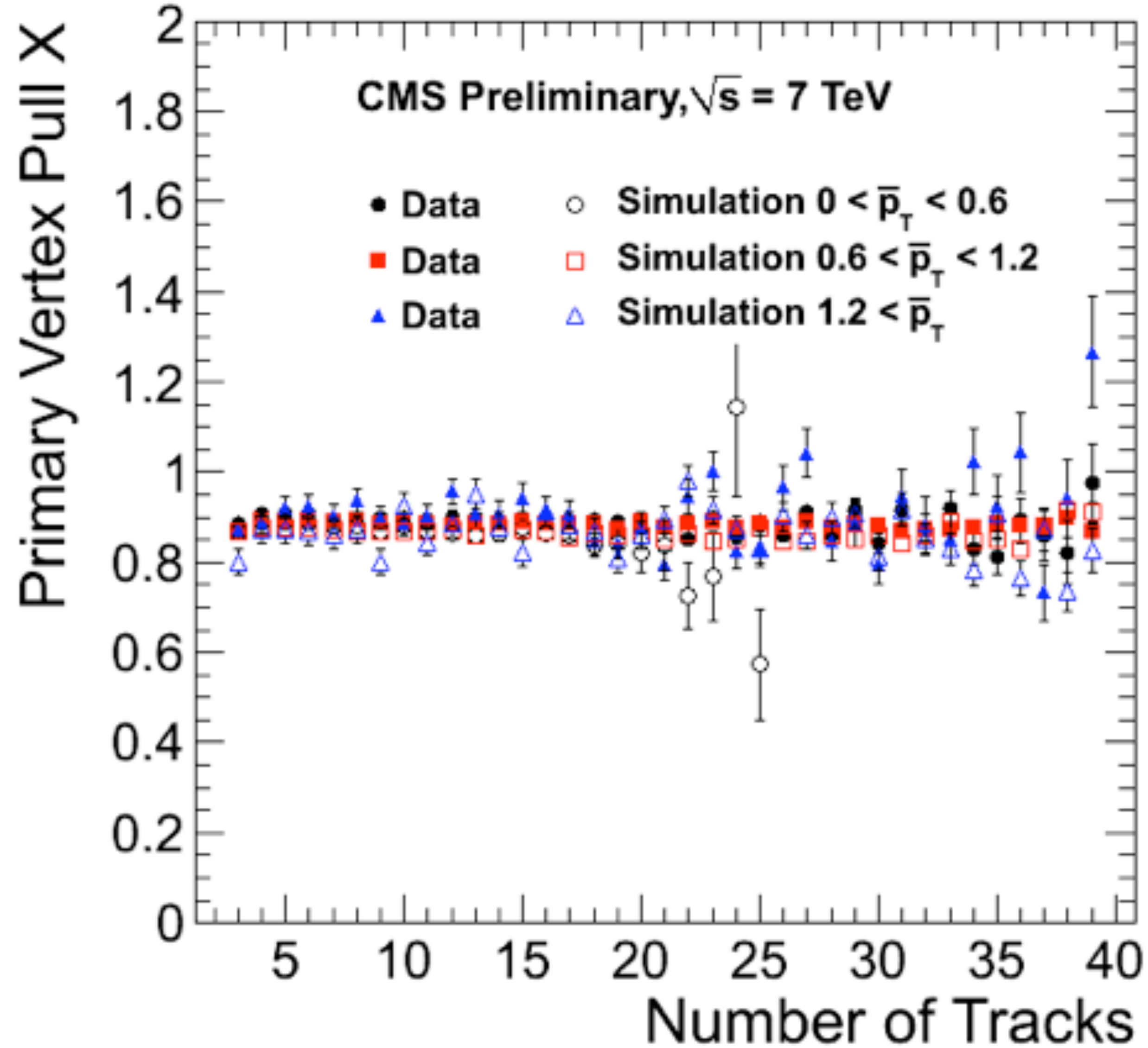
Primary Vertex Pull X vs nTrack

- Pull has an average of ~ 0.9, indicating the error is overestimated





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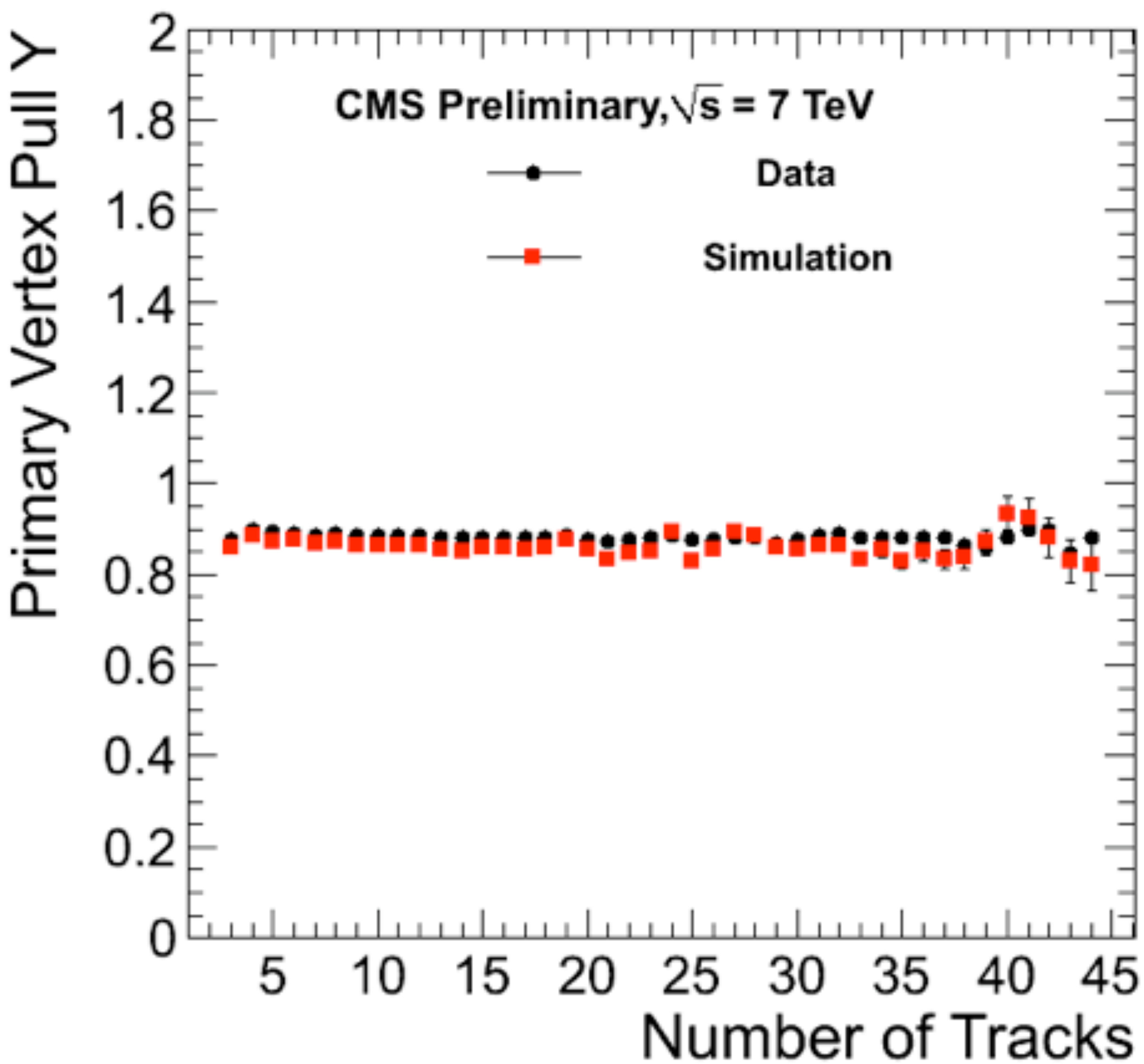

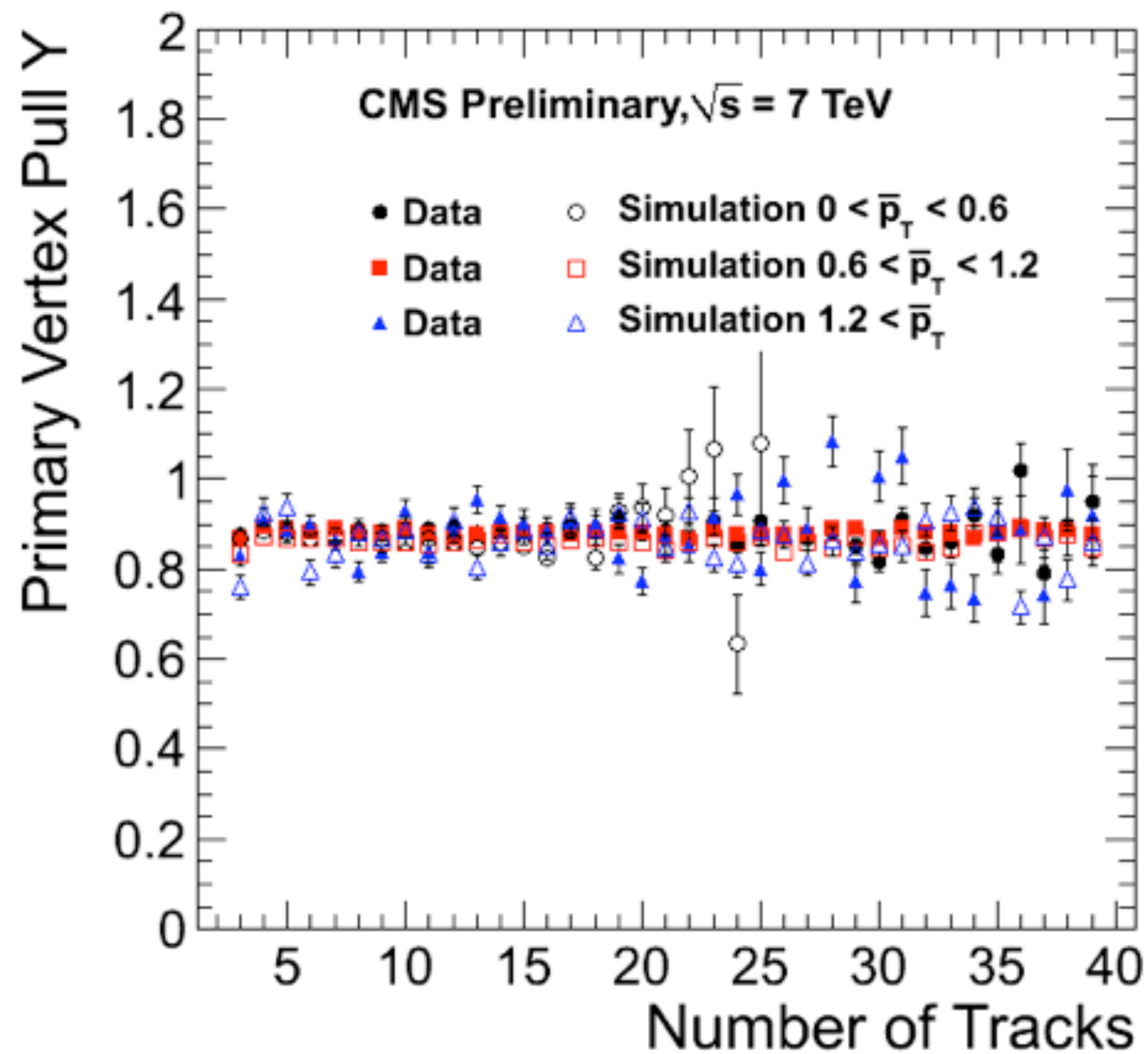

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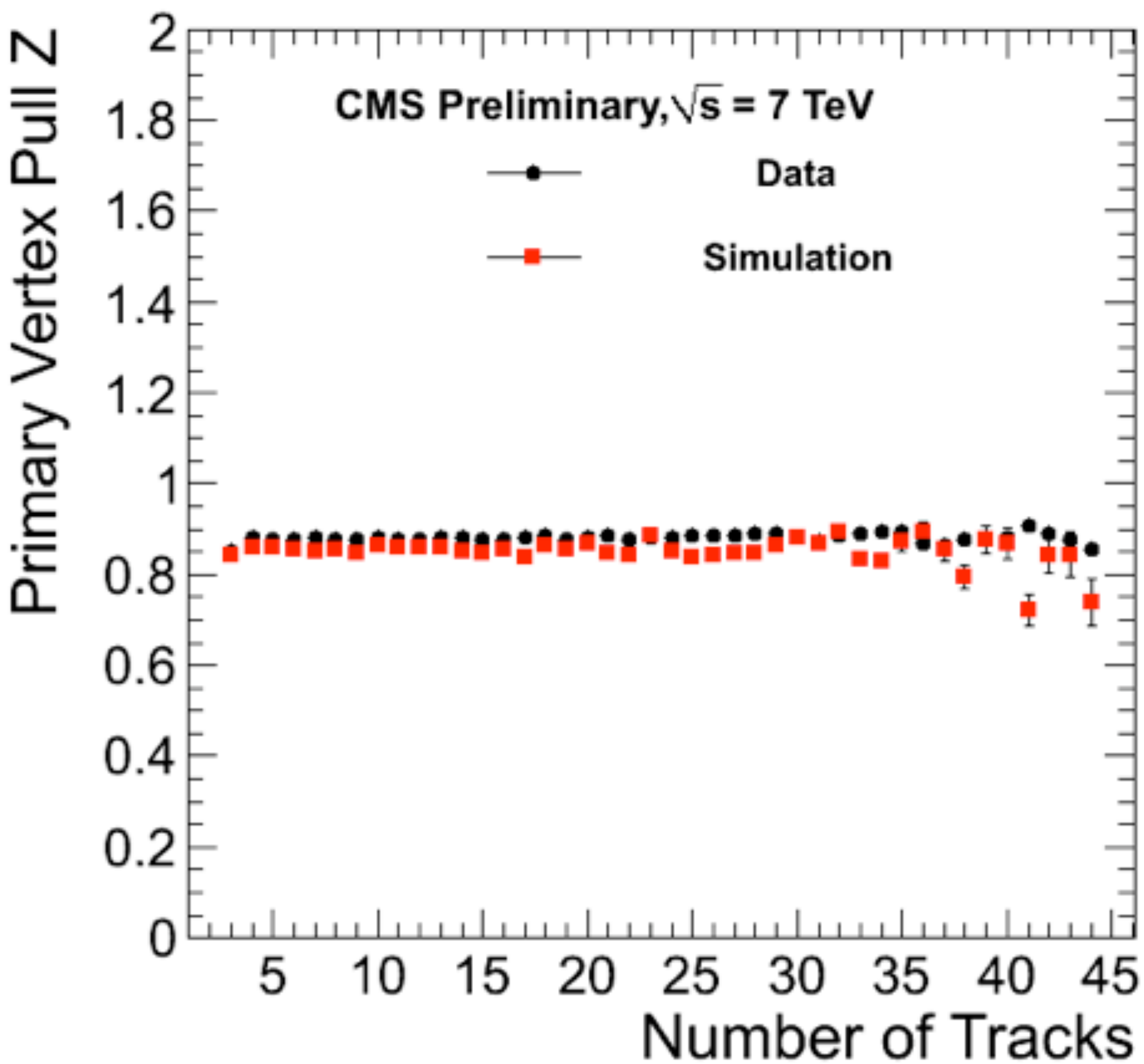
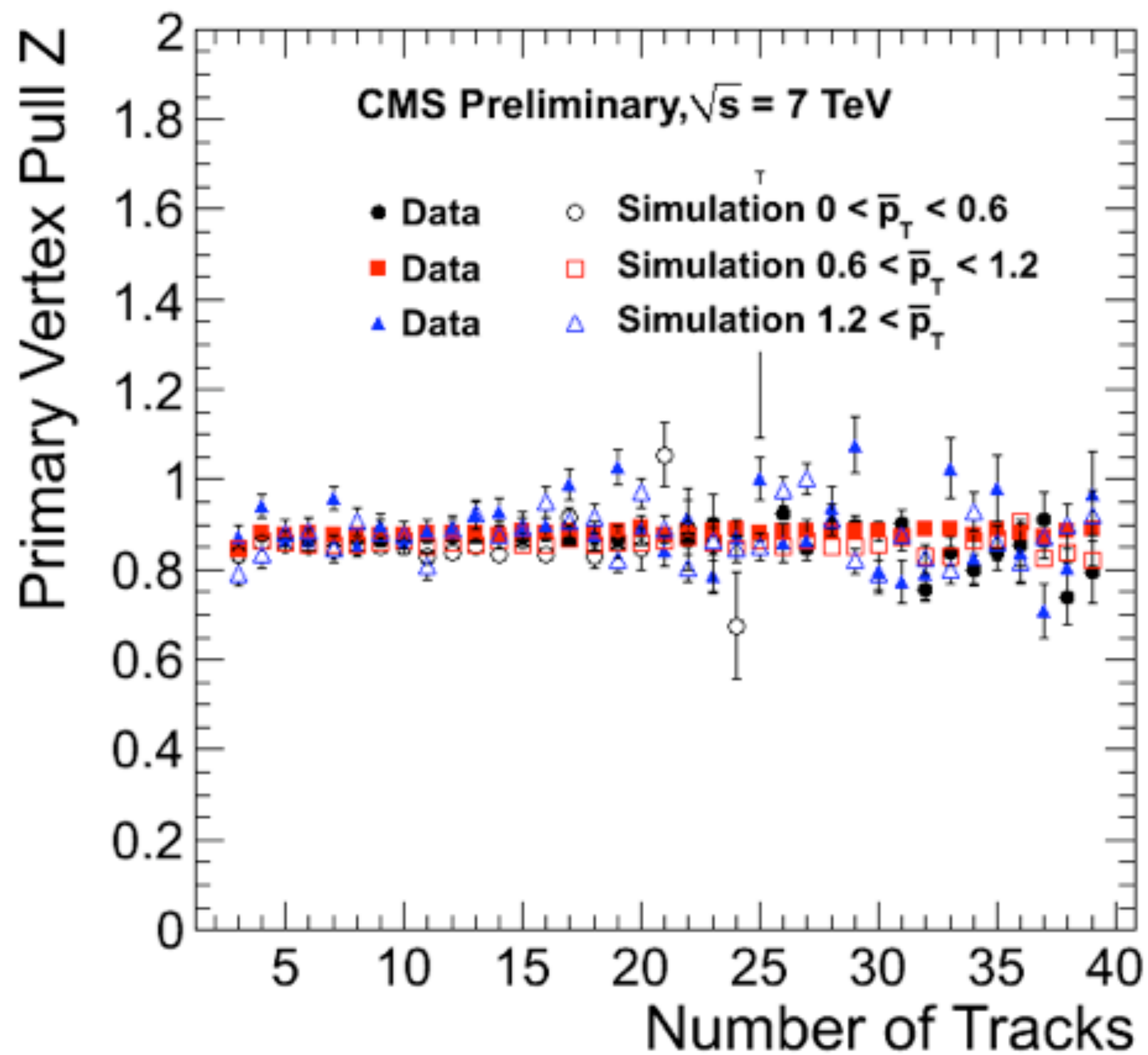




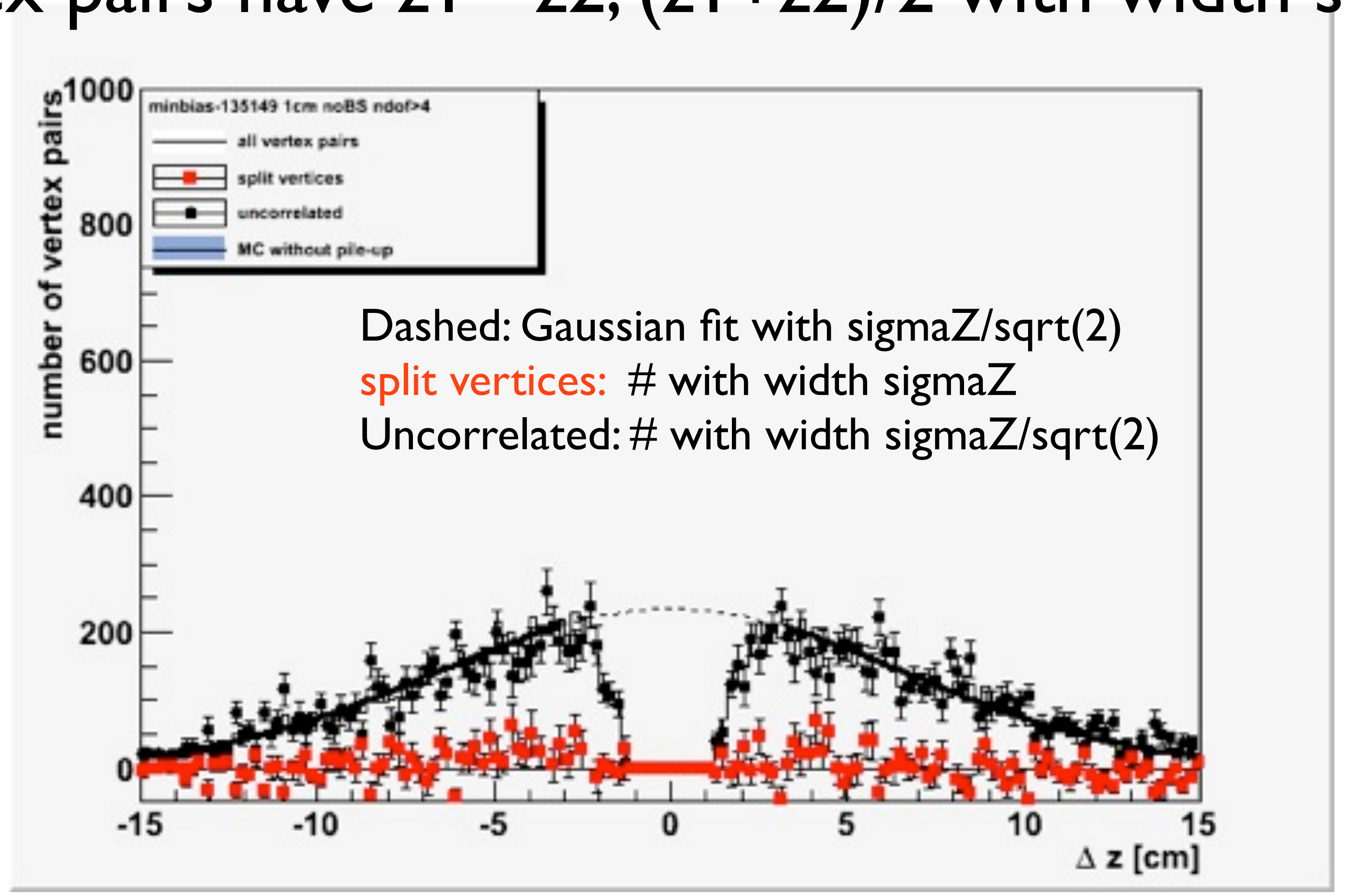
- Plots to be included in PAS

Pile Up Estimation

- Given >1 vertices reconstructed, how often do they represent genuine PUs rather than fake vertices from splitting?
- Exploit the z-correlation of vertex pairs
  - Genuine PU vertex pairs are uncorrelated in z

$$\exp\left[-\frac{1}{2}\frac{z_1^2}{\sigma_z^2}\right]\exp\left[-\frac{1}{2}\frac{z_2^2}{\sigma_z^2}\right] = \exp\left[-\frac{1}{2}\frac{(z_1-z_2)^2}{(\sqrt{2}\sigma_z)^2}\right]\exp\left[-\frac{1}{2}\frac{\bar{z}^2}{(\sqrt{1/2}\sigma_z)^2}\right]$$

  - Split vertex pairs have z1~ z2, (z1+z2)/2 with width sigmaZ (BS)



Wolfram Erdmann

PileUp Estimation

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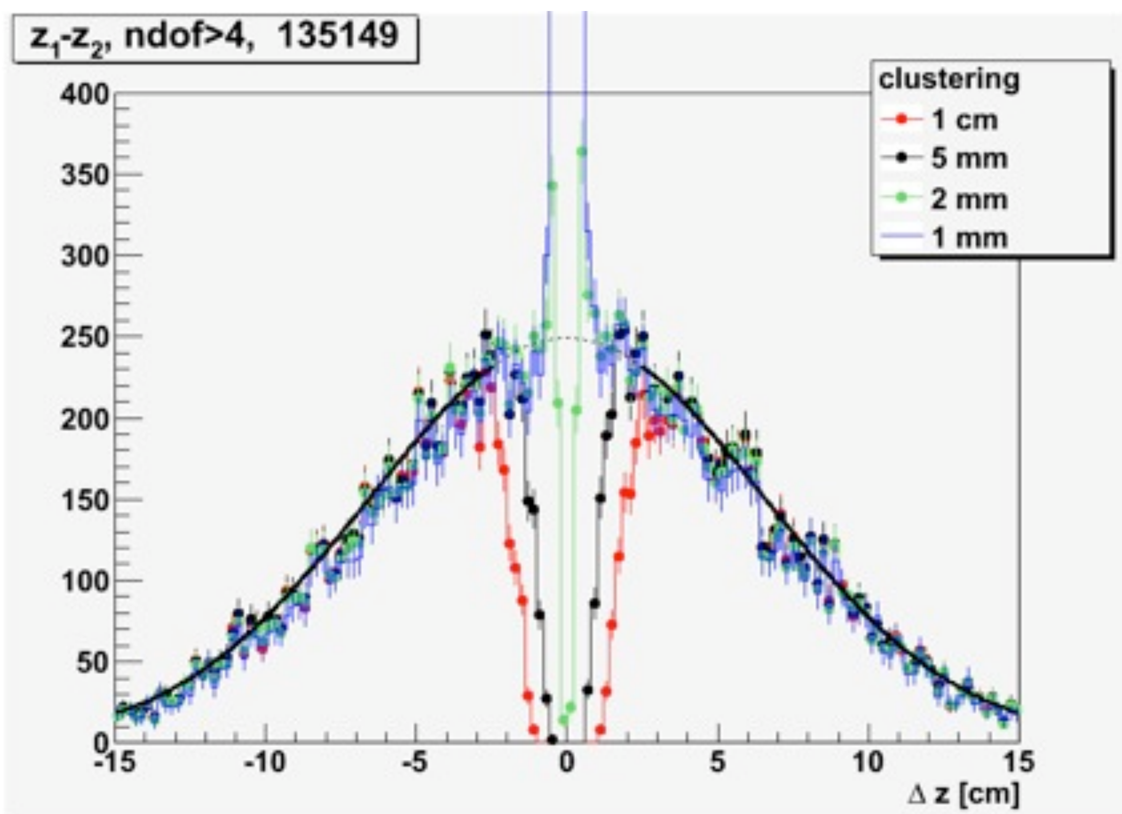
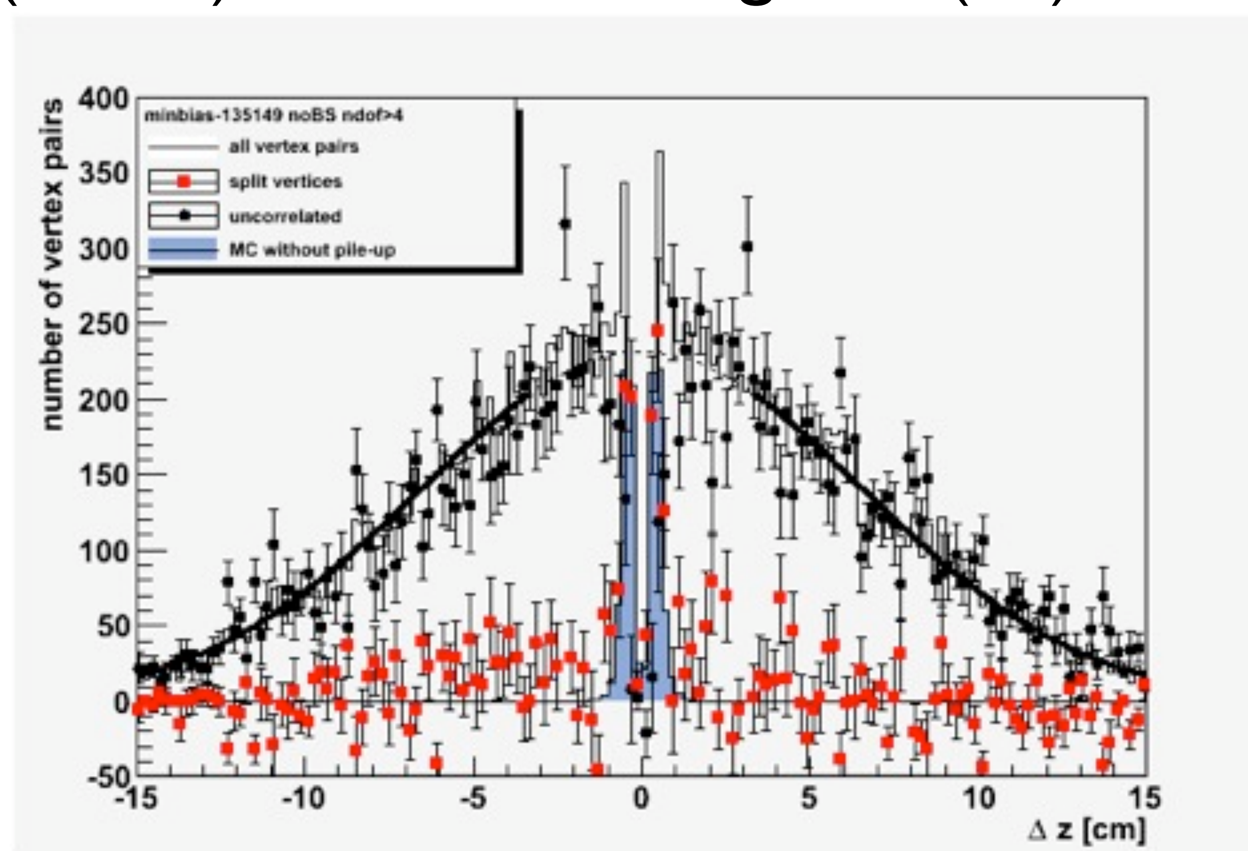
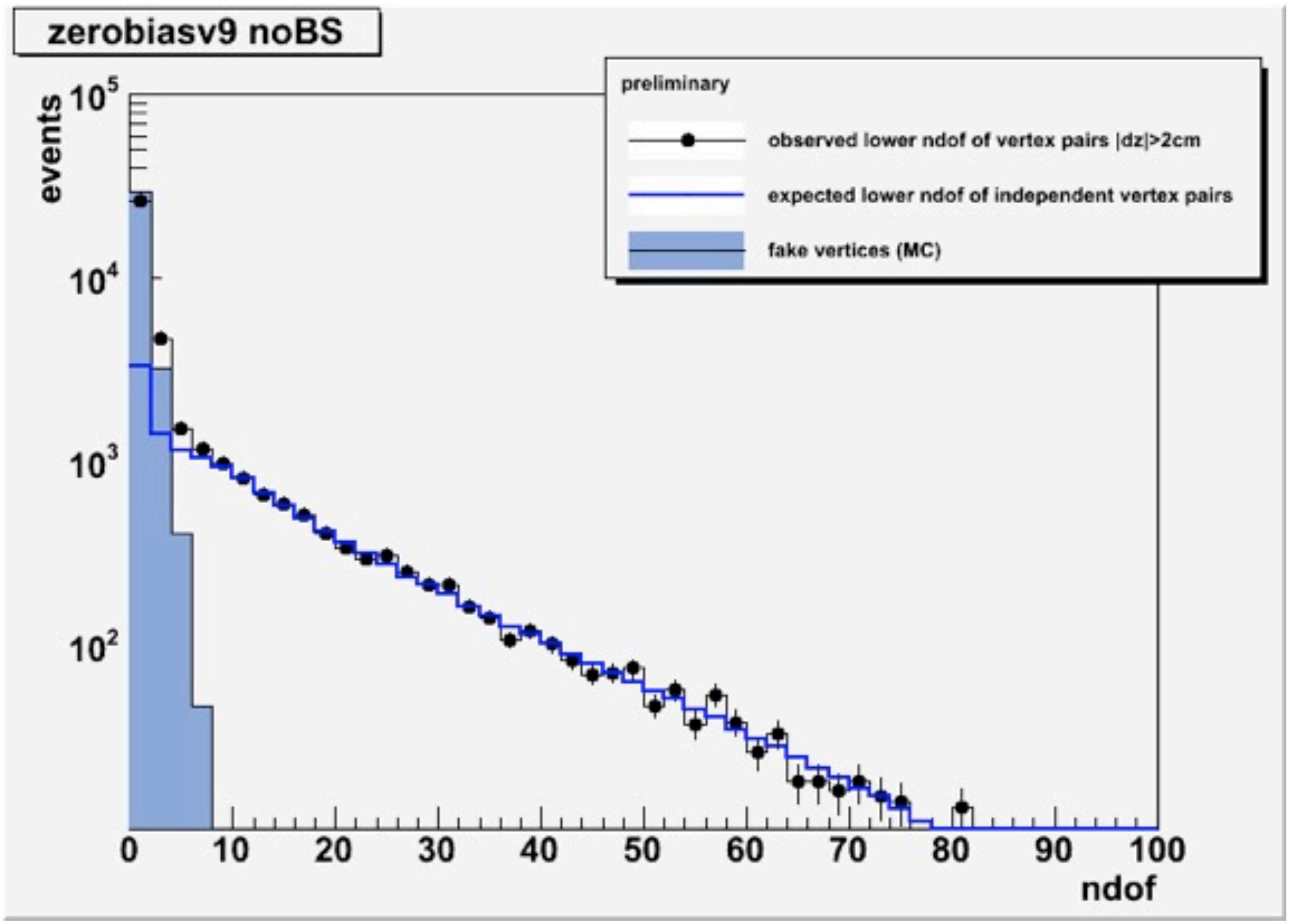




Details in this doc by Wolfram Erdmann: https://twiki.cern.ch/twiki/pub/CMS/TRK10005/pileup.pdf

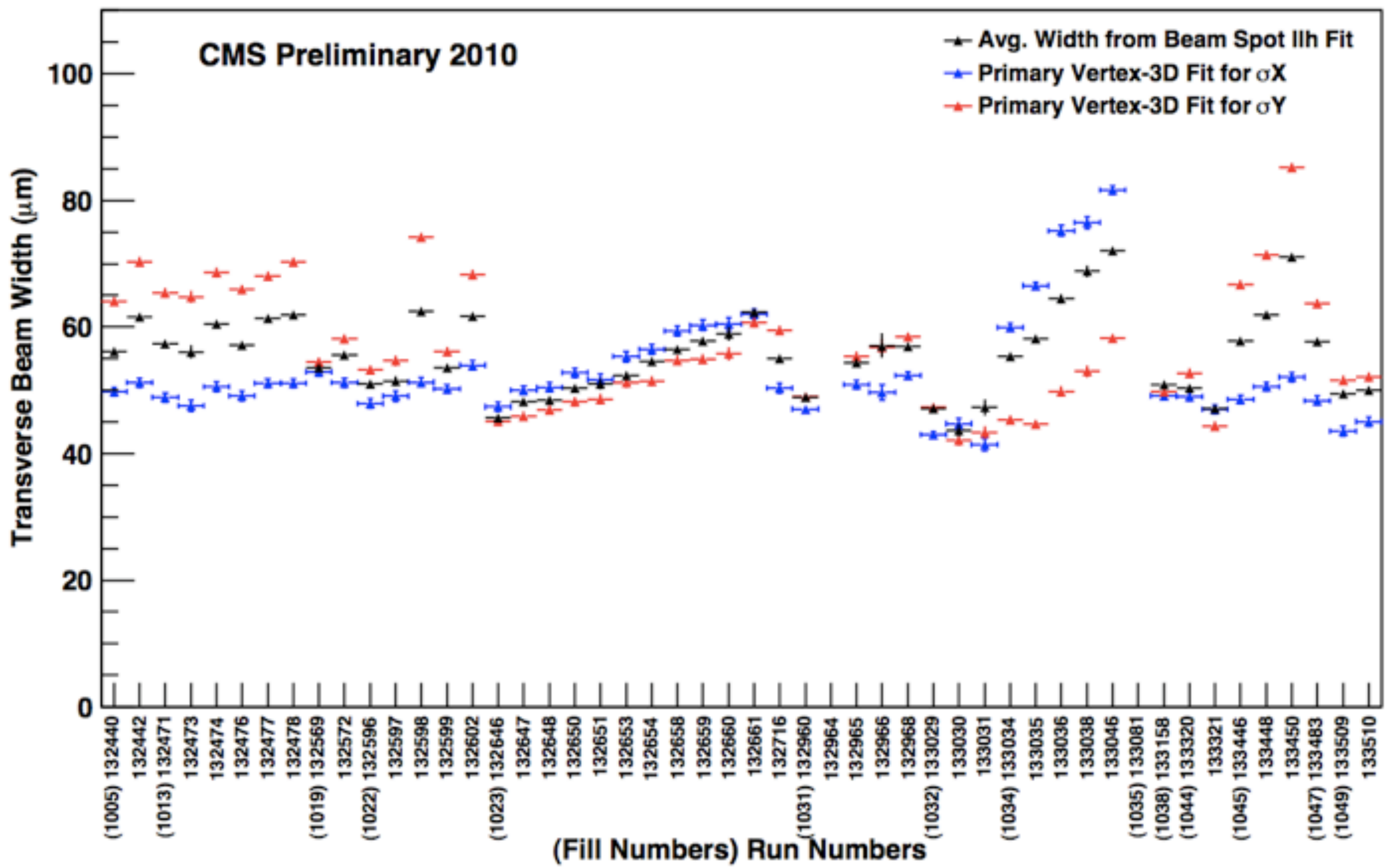
PileUp - Lower Vertex Ndof Distribution

- Data is well represented by MC without PileUp
  - Expectation shape derived from inclusive ndof distribution
  - MC fake is normalized according to?



BeamSpot: Transverse Beam Width

- Transverse beam width obtained by two methods
  - likelihood fit: using impact parameter correlations
  - Vertex-3D Fit for X and Y



- Similar plots for X/Y/Z/Slope are on the way

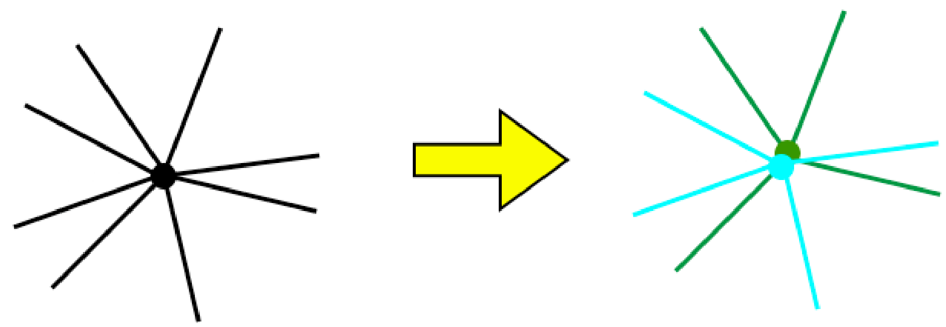
Next Steps

- In general, repeat the studies on the ICHEP dataset/release
  - Are we going to abandon GOODCOLL? If so, what is the state of art?
- Track IP Resolution
  - Complete the resolution vs phi
  - Compare the measured resolution with the error from the track fit
  - Extend pT range with the un-prescaled trigger dataset
- Primary Vertex Reconstruction
  - Repeat the resolution/efficiency studies with un-prescaled trigger dataset
  - Estimate the pile up rate
- BeamSpot
  - Converge and understand the plots to be included

Backup Slides

The Two-Vertex Method

- The algorithm has been approved in TRK-10-001
  - Primary vertex resolutions depend on nTracks used and their $< p_T >$
  - Data-driven "two-vertex" method to measure primary vertex resolution



1. Split tracks into two independent sets
2. Run PrimaryVertexProducer (offlinePrimaryVertices) on each trackset
3. Compare the two fitted vertex positions and calculate
   - Resolution: of the gaussian fit to $\frac{x_1 - x_2}{\sqrt{2}}$
   - Pull: of the gaussian fit to $\frac{x_1 - x_2}{\sqrt{\sigma x_1^2 + \sigma x_2^2}}$

- To estimate the effect from track pT, the procedure is repeated with different average pT Ranges

Reminder: Beam Spot Monitoring

- online beam spot:
  - Beamline position estimated in the online DQM.
  - Two methods (DQM modules): full tracking, and pixel tracks.
  - Results in ~real time (2-3 min): fit lumi-by-lumi. Independent results every 5 lumi sections.
  - Results are send to DIP(LHC), and also injected into raw data via the scalars.
  - Beam spot scalars are being used for express and prompt reconstruction, and will be used also in HLT.
  - This monitoring tools has been shown to be very stable and useful to monitor beam position during data taking.
- offline beam spot:
  - Use express Alcareco samples.
  - New runs usually processed and conditions uploaded in < 1 day.
  - Procedure is still not fully automatized. A lot of work is being done to have this step fully automatize in T0. Need to maintain several DB conditions.
  - The beam spot can be reprocessed like in the case when a new tracker alignment is available.